Preservation and Restoration of Authenticity in Sound Recordings—To Standards

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THE JULY 1972 ISSUE of *Library Trends* was entitled "Trends in Archival and Reference Collections of Recorded Sound." Appropriately, the titles of the articles reflected the particular concerns of the nine authors from as many institutions, including those of the issue editor, Gordon Stevenson. The article which I contributed for that issue was "Preservation and Restoration of Authenticity in Sound Recordings,"[1] to which I now add two important words: "To Standards." I will address myself to Edison's struggle to establish such standards—those used in re-recording his own discs to cylinders.

Actually, this subject has been much more trendy than the author realized in 1972. More objectives were outlined than conclusions reached. A book was written and published recently on the same subject, similarly titled,[2] but omitting the work *authenticity*. The book covers many areas very well—so well, in fact, that I suggest it is a book all archival and reference collections should have, provided it is read critically. Why? Our first clue is in the elimination of the word *authenticity*. If ever there was a trend that is sorely needed, in or out of archives, it is a return toward truth in audio!

In trying to peer into the future, we may discover many major and minor trends. Melville Clark, Syracuse music merchant and inventor of the Clark Irish Harp, collaborated with me in establishing what we agreed was a necessary trend toward perserving the old acoustical

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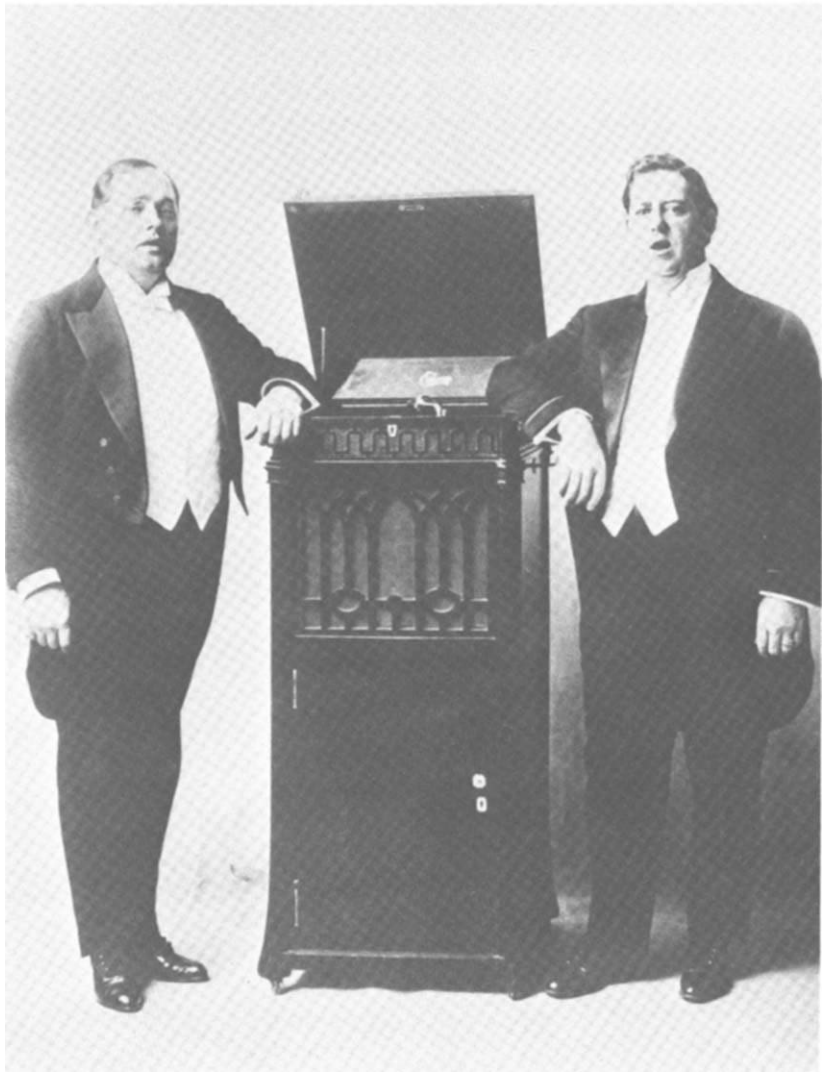
recordings at a time when most people were replacing them with the new Orthophonic Victor or Viva-Tonal Columbia records. Clark, a past president of the National Association of Music Merchants, wrote articles for one or two trade papers about the urgent need to preserve some of the old recordings. Some time later, one small record producer not only expressed an interest, but offered to send metal molds for deposit when they were of no further commercial use. That was in 1930, and as Edison had only the year before left the field to his competitors, few of us really believed that diamond styli would ever come back as the universal medium for tracing all phonograph records produced.

It was Bell Laboratory engineers Maxfield and Harrison, who had applied their theories of matched impedance to the successful electrification of Eldridge R. Johnson's acoustical lateral disc Victrola only a few years before, who were now, in a remarkable reversal, claiming that vertical recording was superior to lateral, and that they had perfected a new system which proved it! This process was later used for Muzak (which now uses tape), and for producing the World Broadcasting Company series of transcriptions. For the first time in a number of years, diamond was again used for playback, but only for radio industry purposes.[3]

Meanwhile, acoustical Orthophonic Victrolas and Columbia Viva-Tonal phonographs were still being made, as well as some others designed for use with steel needles—soft, medium, loud, or extra-loud. All of the electric pickups of the 1930s also used impermanent styli. Tungsten styli were also available from soft to loud. There were gold-plated steel and bronze needles, thorn and cacti needles, and dozens of others. Automatic record players made their appearance both for homes and as jukeboxes, and more permanent styli were desperately needed. Also, it soon became evident that the movement toward all-electric reproduction was more than a trend—it was inevitable!

Despite the production problems Edison had encountered in 1912 with the Diamond Discs, he and his associates had persisted. By 1915 enough of the problems had been surmounted that Edison finally permitted what is considered to have been the first publicly conducted tone test. Metropolitan Opera artist Anna Case sang in comparison with her own voice as reproduced by the new Official Laboratory Model Phonograph before guests in the library of the Edison Laboratory at West Orange, New Jersey. The listeners, unable to distinguish any differences, were understandably amazed. The recorded voice of Anna Case was then transmitted by wire to San Francisco to Edison, who was being honored at the inauguration of regular cross-country telephony as an event of the Panama-Pacific International Exposition.



EDISON TONE-TEST PUBLICITY PHOTOGRAPH FEATURING ARTHUR MIDDLETON AND KARL JORN

That was the first of many tone tests arranged by Thomas A. Edison, Inc. from 1915 to 1927, which ceased when electrification of the Edison methods began. Tone tests were conducted in music rooms and auditoriums large and small from coast to coast. In many instances the lights would go out, and the audience would wonder whether or not the singer was the one singing; when the lights would come on again, the singer would have vanished!

In retrospect, the Bell engineers, through conquering Johnson's Victor Gramophonic world empire first and ignoring Edison's accomplishments, lost the valuable and ultimate test of direct comparison. Compton Mackenzie, founder of *The Gramophone,* later lamented this lack of a standard instrument with tone-testing capabilities in an editorial comment during a time when there were endless arguments over the merits of various recording methods then being employed.[4]

Looking back from 1981, we must concede that even the lateral disc mono LP records produced since 1951 by so many companies and in so many countries have been relegated to all but complete obsolescence by the industry and its advertising, just as surely as the so-called 78s and vertical-cut cylinders and discs are now totally out of use for either entertainment or education.

Undeniably, internecine competition in the record industry has produced great profits. However, the advertising slogan of the pioneers, "now recorded for posterity," has proven to be a vast deception in regard to access—by teachers, scholars or the public—to the greater part of the recorded voices of the past or historic performance of the great artists.

In inventing the phonograph, Edison did not have to make a choice between cylinder, disc or tape. All these forms of moving surface were already in the arts for a multitude of purposes, and therefore in 1877, as now, were not patentable features. In experiments he had used all three; an example is an experimental disc model with clock-spring motors in 1873. The reason he chose to develop the cylinder first is that it had the highly desirable attribute of uniform surface speed under both cutting and reproducing styli from beginning to end of a recording of any length. The lack of this uniform speed is a fundamental fault in present-day phono stereo systems, just as it was in Edison's disc phonograph.

In the stress of trying to catch up with Eldridge R. Johnson's great commercial success in creating a worldwide Victor Gramophone empire, Edison and his associates went along with Johnson's constant-rpm sytem utilizing ten-inch and twelve-inch discs which Johnson and his foreign Gramophone allies had settled upon as most suitable. Constant-rpm, then as now, requires built-in compensatory measures

in both recording and reproducing, whether acoustically or electrically. This is because the outer turns of a ten- or twelve-inch disc are traveling much faster than the inner turns near the label. C.S. Tainter, an associate of Alexander Graham Bell, received a patent on a constant-groove-speed cutting lathe even before Bell's Gramophone Company entered into the disc competititon, but it was never used. Also, in 1923, an English inventor made a controller for gramophones so that constant groove speed could be used on them. This had modest commercial success, failing largely from lack of artists and capital.

Although the Edison Laboratories concentrated to produce an ideal new disc, work was not neglected on improving the cylinders as well. First, Wax Amberols and the later Blue Amberols with a beautifully smooth surface were perfected and put on the market. A problem to be overcome in producing the discs was the need for a flat, hard and unyielding material for both surface and core. Without the experience of modern plastics technology to guide them—for they were truly among the earliest pioneers—the Edison men determined that the surface should remain flat and durable when bonded to a specially pre-prepared core. (This procedure corresponded in principle with the way the Blue Amberol celluloid surface was related to the supporting plaster-of-paris cylinder cores, though celluloid was not deemed hard and unyielding enough for the discs.) Edison, himself a chemist, brought in some other experts and developed a much harder material for disc surfaces. A sophisticated process, invovling the polymerization of a phenolic resin, produced a thermo-setting plastic in liquid form which he called "condensite varnish." The core was composed of wood-flour, resins, lampblack and a bituminous binder, which under heat and pressure was formed into a quarter-inch-thick blank somewhat larger than the finished disc size, to which it was trimmed during final processing.

To receive the recording impressions from the molds, the core surfaces were coated with a suitable thickness of the condensite varnish. Unlike the way Victor records were pressed (that is, by squeezing a semimolten shellac, powdered limestone and carbon-black "biscuit" between two molds with great pressure), the Edison disc molds by comparison were gently pressed onto the condensite surface, which required heat but much less pressure. Naturally, this extended the useful life of the molds and prevented impairment of delicate overtones, so very important to the tone tests. Because of this method, the finished discs were called "prints" in the laboratory literature. Despite production difficulties, the Edison discs produced this way wore very well and did

not demodulate measurably, despite the great tracking pressures imposed for acoustical reproduction. Our current vinyl stereo discs do demodulate, although they are only partially vertical. (Some authorities recommend that vinyl discs rest twenty-four hours between playings to minimize the extent of wear somewhat.)

As if to dramatize the importance of the technical difference in materials, Edison used self-labels created by photographic means and imprinted onto the condensite varnish at the same time as the spiral groove. Photographic halftones were used at first as background, with brightly reflected lettering, Edison's signature, and lineal outlines for such decorative features as two shields—one for Edison's photograph and the other for typeset patent information. These features varied over about a decade. They were beautiful, but difficult to read!

In view of his attention to details as well as to fundamentals, it is difficult to understand why Edison did not insist that constant groove speed should be a requirement for the new system. Besides this mistake, if it may be so deemed, Edison had other problems the first few years with the new discs. They began very soon, with the peeling away of the condensite surface around the circumference due to unequal shrinkage of surface and core. Sometimes the surface would split through the grooves. Essential chemicals imported from Germany became unavailable after the Allied blockade of that country in 1914. One chemical, phenol (carbolic acid), was an essential in the production of condensite. Edison invented a synthetic equivalent and provided it to all users after the supply of phenol was shut off, but another finishing chemical proved much more difficult to duplicate, resulting in surface noise problems. The earlier records had a playing surface that was superbly smooth; unfortunately, most of them also had the problems of peeling and splitting, so relatively few are left. Meanwhile, Edison was spending much time in Washington as chairman of the Naval Research Board, dealing directly with the submarine problem.

During the war years, surface noise was a problem with all disc records, especially in the United States, for virgin shellac—imported from India and essential for producing smooth lateral disc records—also became difficult to obtain. This factor may have been partially responsible for increased sales of the smoother Blue Amberol cylinders and the Amberola phonographs. Sometimes the cylinders were smoother than the issued discs of the same performances! In researching the best ways to reduce the surface noise in re-recording from the discs, we have discovered that it is usually most troublesome in the first half-inch of stylus travel normal to the spiral. From this, it is obvious

why none of the twelve-inch waxes made from 1910 to 1912 were ever processed by Thomas A. Edison, Inc. for commercial use as discs.

Whether or not the needed chemical was available after the war, Paul Kasakov, chemist in charge of record production for Edison, perfected in 1920 a new high-speed plating process. Moreover, the record surfaces were improved markedly. As a result, twelve-inch sample discs of new issues, with excerpts dubbed from each selection, were prepared for distribution to buyers through Edison outlets.

In late 1926, the Edison company made a great tactical mistake in the announcement of Edison Long Playing Records and Long Playing Phonographs in answer to the challenge of the Orthophonic Victrola. The process was an excellent one, except that the playback stylus, although a diamond, was shaped by an inadequate, expedient means. The result was that the boat-shaped stylus would often break through the tiny margin of land between the 450-groove-turn/inch discs, and thereafter would repeat.

Moreover, the Edison catalog did not have complete symphonies or Broadway shows (as did Victor and Columbia) for which longer-playing records would be so desirable. The Edison LP promotion was a flop. Twenty years later, the mini-groove LPs of Victor and the 45s of Columbia used sapphire styli.

Even with 80 rpm and the standard Edison record (now bearing white labels), some of the most amazingly natural records were recorded electrically for reproduction using the Edison Official Laboratory Model Phonograph *as a standard.* Even though a special louder reproducer called the Edisonic was made available, it is evident that Edison insisted that the 1915 standard be adhered to as far as the vertical discs were concerned.

Edison's associates later asked for, and received, permission to produce a series of ten-inch and twelve-inch needle-type records for which packets of Edison steel needles were furnished. The objective was to produce additional income by selling needle-type records, recorded at the same time as the diamond discs, to the owners of the new Victor, Columbia and Brunswick machines available prior to 1929. Unfortunately, Edison found that despite excellent quality of sound, the new records made of shellac were very prone to warp.

Edison had had all he could take, and in the fall of 1929, as chairman of the board, he ordered that all manufacture and sale of home phonographs and records cease. Thus far, the only recording system which provided a standard playback instrument over a number of years was the Edison Diamond Disc process. It is also singular in having

passed the ultimate test of successful public comparisons of commercial discs with the live artists. It is time to combine this kind of idealism with our marvelous technology and begin again to deliver truth in audio!

SEAL—EDISON OFFICIAL LABORATORY MODEL PHONOGRAPH

Note: Mr. Welch's chief consultant on matters of physics and chemistry is Dr. Robert J. Conan, Jr., Professor of Physical Chemistry, LeMoyne College, Syracuse, New York.

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